RECONNAISSANCE SURVEILLANCE AND TARGETING VEHICLE (RST-V)

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RECONNAISSANCE, SURVEILLANCE, & TARGETING
(MEEV)

Objective:
- Develop and demonstrate advanced hybrid electric drive and survivability technologies for lightweight recon/scout vehicles deployable via V-22 aircraft

Capabilities:
- High tactical mobility and fuel efficiency
- V-22 internally transportable
- Silent Operations/Integrated survivability
- Onboard power for payloads, aux systems
- Multi-Service/Program technology fed

Technical Approach:
- Joint DARPA, USMC
- Technology Demonstration (TD) Program
- Utilize the 845/804 OT Acq. Strategy
- Design, build, and evaluate advanced HED, survivability, and automotive technologies
- Evaluate during AWE's, User Demos
- Transition to MEEEV, SOCOM

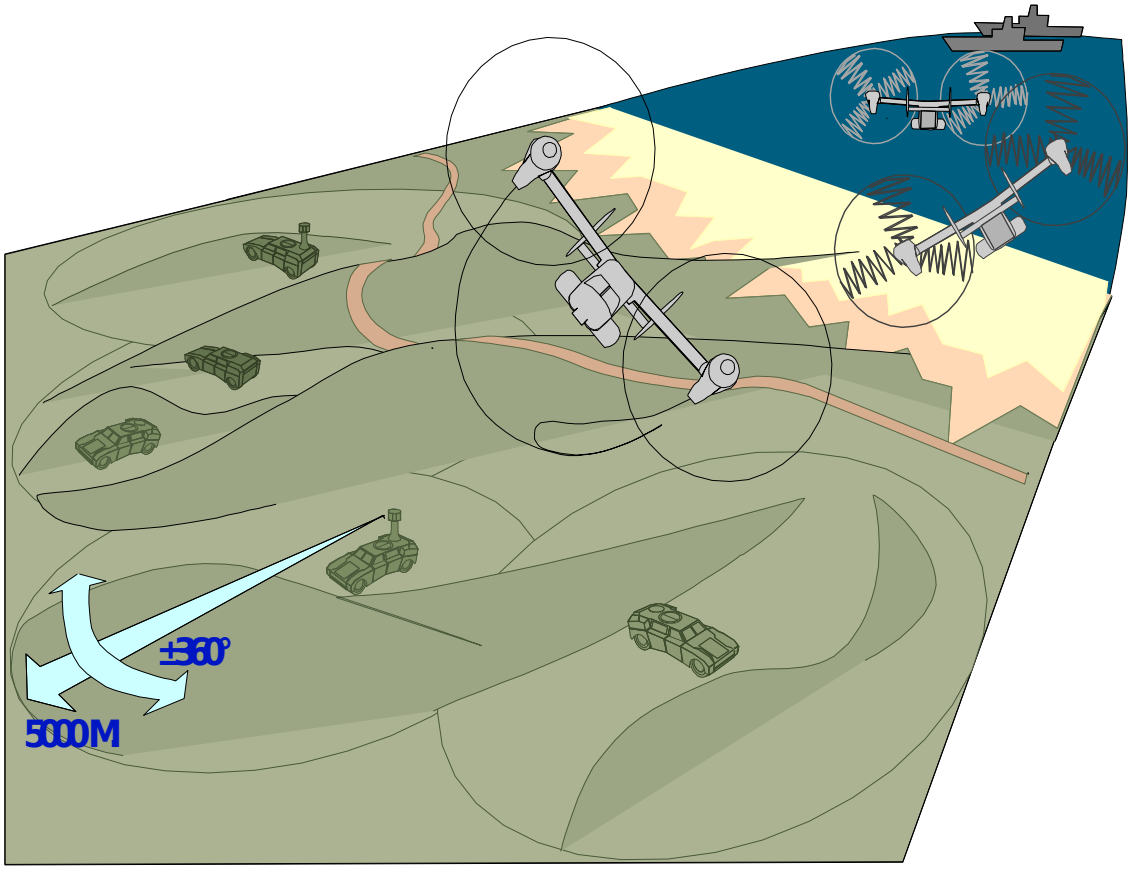
Schedule:

TASKS	FY01	FY02	FY03	FY04
Integrated System Teams				
TD design improvements				
TD fabrication/test				
Deliver vehicles to Govt				
Gov't testing/demos				
Transition/program end				

GENERAL DYNAMICS
Land Systems

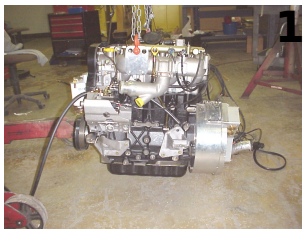
System Concept

- **V-22 Internal Transport**
  - Deployment Ready
  - Tactical and Deep Insertion
  - 10 Day Mission
- **Integrated Survivability**
  - Ballistic
  - AP Mine
  - Managed Signature
- **Hybrid Electric Drive**
  - Improved Fuel Economy
  - Improved Range
  - Extended Silent Watch



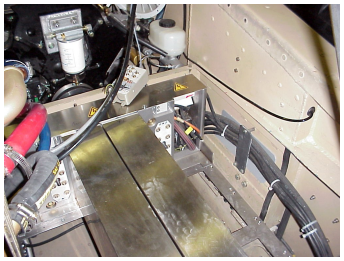
Key Automotive Features

HV Batteries Low but, Accessible



155 Hp Commercial Diesel

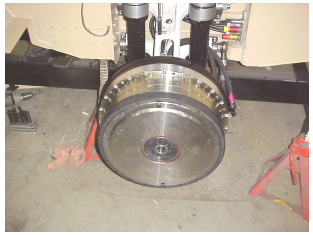
Variable Speed Cooling Fans



Independently Removable Propulsion Elements

Steering Rack

Wheel Motor Assy



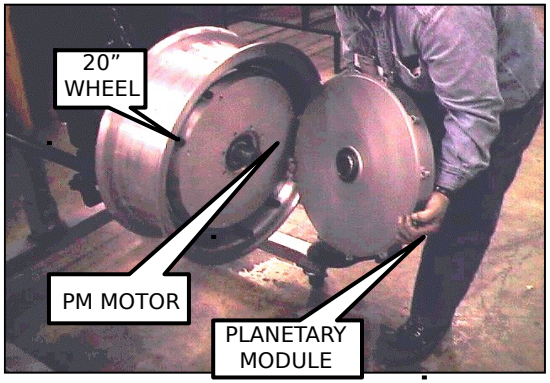
Modular Folding Suspension Assy Fits All Corners

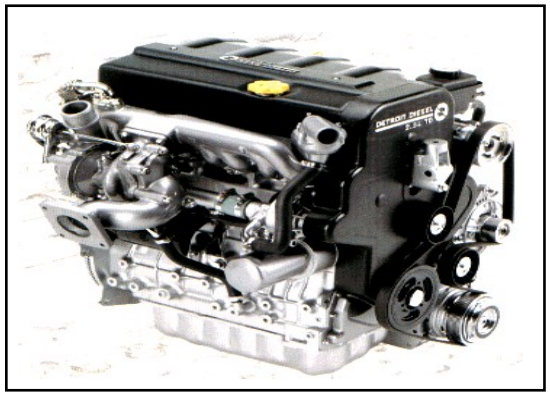
Stiff, Closed, Low-profile Frame, All Aluminum Construction

Key Subsystems

Wheel Drive Unit

- MM Permanent Magnet Motor
- Modular Design
- Push Start With Dead Batteries
- Torque 3660 Nm (Peak) 3030 Nm (Continuous)





IC Engine

- DDC TD DI-4V, 2.5 liter,
- Maximum intermittent power 105 kW (141 hp) at 3800 rpm
- Common Rail Direct Injection Diesel
- Turbocharged, Intercooled

Energy Storage

- Saft Lithium-Ion Battery Technology
- EV Optimized Battery Chosen for Application
- 2 Packs, 60 HE 44 Cells - ~234V
- Burst Power 60 kW

Program Status

- 1st two vehicles used as automotive test rigs
- 2nd two vehicles, configured as 2nd generation with lessons learned incorporated
- Demonstrated superior mobility and survivability over current vehicles (HMMWV, IFAV)
- Accumulated >6500 km on fleet, mixed terrain.
  - 1000 mile road march
  - 1000 mile off-road testing for FCS LSI
- Packaged and demonstrated in-hub electric drive, high density electrical power conversion, and high density hybrid energy storage

Recent Accomplishments

Demonstrated the following capabilities during The Technical Performance Measure Testing at Bosch Automotive Proving Ground, April 2003:

- **Ascended 60% vertical slope in all three modes (engine-only, battery-only, and hybrid-electric)**
- **20 miles run on silent run mode with 8440 lbs GVW (battery-only), top speed 57 MPH**
- **Negotiated 24 inch vertical step in both forward and reverse directions**
- **Maintained a speed of not less than 70 mph on dry, level surface for 20 minutes with no component malfunction**
- **Traversed a 60 inch ditch from complete stop**
- **Acceleration:**
  - **0 – 30 MPH, 3.4 sec (HMMWV 9.4 sec)**
  - **0 – 60 MPH, 12.1 sec (HMMWV 26.1 sec)**

60% Grade Climb

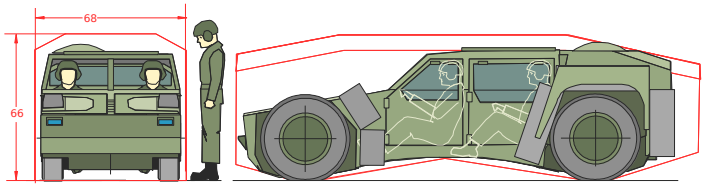
Contractor TPM Testing

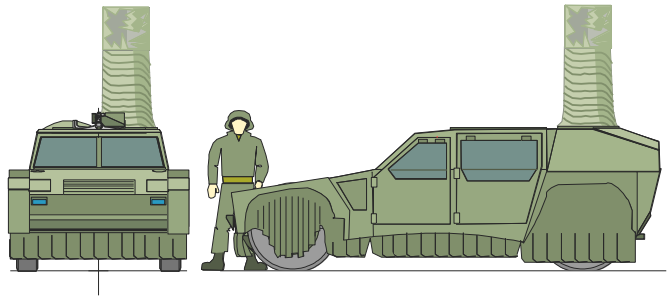
Event *	RST-V Achieved	RST-V Goal	HMMWV
0-30 MPH	3.41 sec	4 sec	9.4 sec
0-60 MPH sec	12.1 Sec	15 sec	(0 - 50) 26.1
Top Speed 70 MPH	70 MPH	70 MPH	
Top Speed on Batteries (Recorded) 0 MPH	57 MPH	No Goal	
Distance on Battery (GVW 6800 lbs) 0 miles	23 miles	20 miles	
Distance on Battery (GVW 8440 lbs) 0 miles	20 miles	20 miles	
Step Climb No Data	24 inches	15 inches	
Negotiate 60% Slope (All 3 Modes)	Yes	Yes	

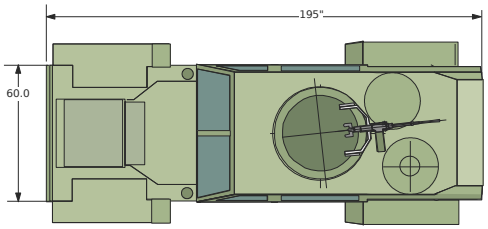
* All data drawn from AM General HMMWV brochure.

RST-V Performance

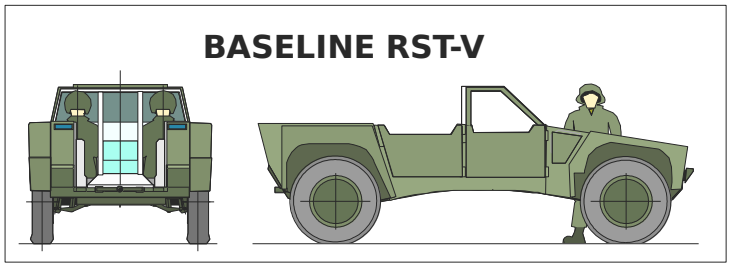
Characteristics	RST-V Design	HMMWV (M1025A2)	RST-V Measured
Gross Vehicle Weight	8000 lbs	10300 lbs	8440 lbs
Chassis Width	60 in	84 in	60 in
Approach Angle	60 deg.	60 deg.	60 deg.
Departure Angle	60 deg.	40 deg.	60 deg.
Reducible Height	65.0 in	72 in	65.0 in
Ground Clearance	4-24 in (variable)	15.3 in	4-24 in (variable)
Acceleration 0-30 mph	4 sec	9.4 sec	3.4 sec
0-60 mph	15 sec	25+ sec	12.1 sec
Braking 30-0 mph	69 ft.		47 ft.
60-0 mph	256 ft.		195 ft.
Step Climb	16 in	16 in	24 in
Gradeability (HEV)	60%	60%	60%
(Batteries)	No Requirement	Not Applicable	60%
Side Slope	40%	40%	>40% (90% on tilt table)
Range on Batteries	20 mi	Not Applicable	23 mi
Dash Speed	70 mph	70 mph	70 mph
Dash Speed (Batteries)	No Requirement	Not Applicable	57 mph
Sustained Highway Speed	68 mph (tire limited)	70 mph	68 mph (tire limited)
Payload	3000 lbs	3520 lbs	3000 lbs (by analysis)
Air Transport	V-22, CH53, CH47	C130	V-22, CH53, CH47 (by analysis)
Range (HEV)	450 mi	270 mi	test pending
Relative Fuel Economy	1.5-2.0 x	Reference	test pending
Fording Depth	36 in	36 in	36 in (by analysis)
Ride Limiting Speed	~22 mph	~12 mph	test pending
VCI - Off Road (25% Deflection)	19.8	20.2	19.8 (by analysis)

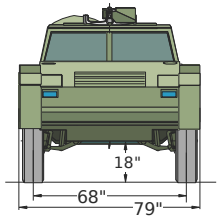


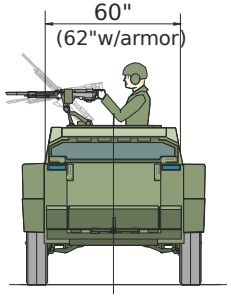


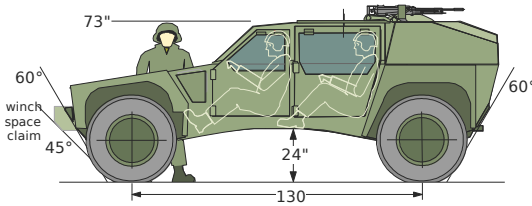


BASELINE RST-V









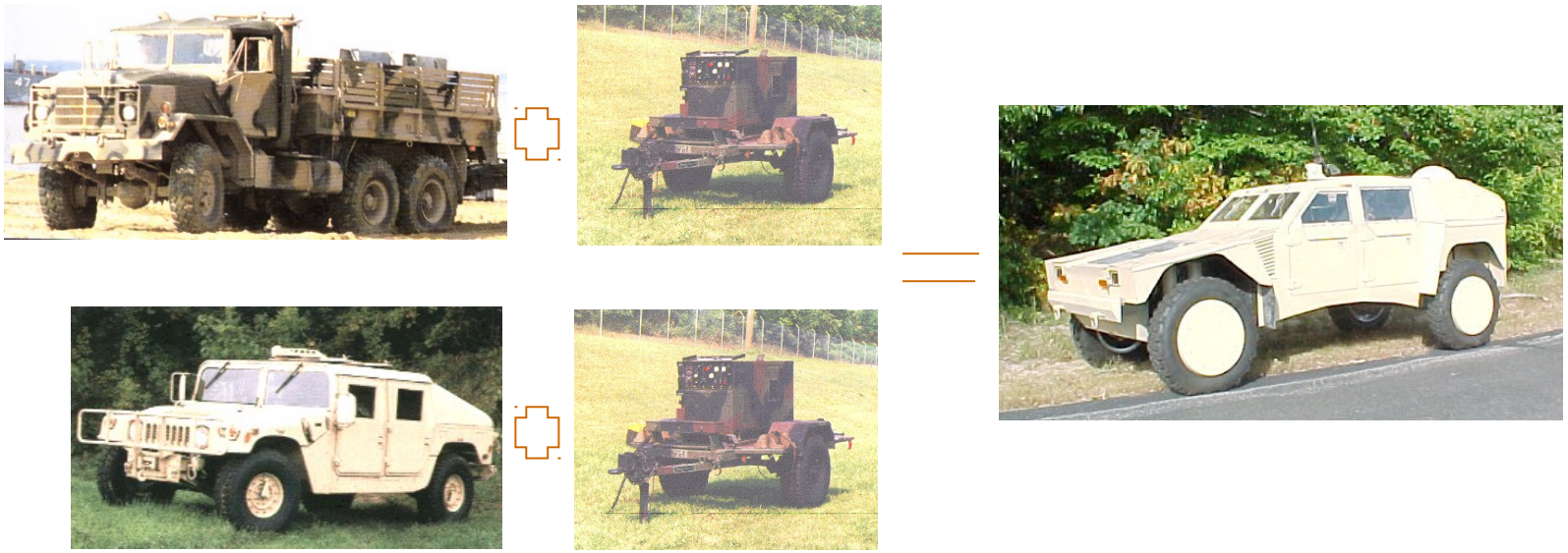
Upcoming Events

- **Continue Technical Performance Measure Testing, Muskegon, MI (June 03)**

- **Joint User Evaluation and Testing, Yuma proving Ground, AZ (August 03)**
  - **USMC and SOCOM participant**

60 kW Generator Retrofit

- **Late FY 03 start; Objective is to convert a RSTV into a 60 kW mobile power generator to reduce battlefield logistical burden**



Retrofit vs. "Clean-Sheet" Vehicle Development

JTEV

HTTV

HTTMMP w/AEDT

RSTV

HE-HMMWV

- High degree of design flexibility
- Fresh ideas easier to implement
- Sometimes forced to custom components
- High maintenance burden
- Always something to "tinker" with

- Proven, user-accepted military platform
- Reliable automotive systems in place
- Economies of scale advantages
- Limited design flexibility
- May be forced to choose sub-optimal components